IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN THE APPLICATION OF: DIANE M. ARTMAN ET AL.

DOCKET NO.: 3226-01 CUSTOMER NUMBER: 26645

SERIAL NO.: 10/554,481 EXAMINER: T. OLADAPO

FILED: OCTOBER 24, 2005 GROUP ART UNIT: 1797

TITLE: DIESEL LUBRICANT LOW IN SULFUR AND PHOSPHORUS
Wickliffe, Ohio

Hon. Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Sir:

DECLARATION UNDER 37 C.F.R. §1.132

I, Virginia A. Carrick, declare as follows:

I received a Bachelor of Science degree with a major in chemistry in 1986 from John Carroll University. I have been employed by The Lubrizol Corporation since 1987 as a chemist. Since 1992 I have been responsible for formulating lubricants for various engines including stationary gas, heavy duty diesel, passenger car, compressed natural gas, and 4 stroke motorcycle engines. I am one of the inventors in the above-mentioned application. and I am familiar with the references which were used in the rejection thereof.

In order to further illustrate the improvement in performance of the compositions of the above invention, the following experiments were performed under my direction:

A series of lubricant formulations were prepared to demonstrate that the improvement brought about by the present invention persists across the scope of the claims, or to identify any areas within the claims where the improvement may not be evident. In the first set of experiments, I reproduced the composition of example 12 of my November 2010 declaration, except that I varied the specific types and amounts of the sulfurized olefin and, for examples F and G, I added additional zinc dialkyldithiophosphate ("ZDDP") in order to increase the phosphorus level of the test compositions. The amounts of the conventional components as listed include the amount of diluent oil that is present in the commercial material. Each sample was subjected to the HFRR

wear test, as described in my declaration submitted July 12, 2010. As before, results are reported as wear scar diameter on the ball, in μm, and lower number are better.

Table I

Component (wt%) Ex: and results	A	B	C	D	E	F	G
Base oils	balance to = 100%						
Conventional additive components							
Viscosity modifier (91% oil)	2	2	2	2	2	2	2
Pour point depressant (60% oil)	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Succinimide disp't (30% oil)	7	7	7	7	7	7	7
ZDDP (9% oil)	0.3	0.3	0.3	0.3	0.3	**0.8**	**0.8**
Antioxidants	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Commercial Mo compound	0.054	0.054	0.054	0.054	0.054	0.054	0.054
Overbased Ca salicylate detergents (45% oil)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Sulfurized olefin type							
Sulfurized carbobutoxy cyclohexene, %	0.15	0.5	0.75			0.5	—
Sulfurized C_{12}-C_{18} olefins, %				0.5			
Sulfurized lard and vegetable oils, %					0.5		
Phosphorus, %	0.030	0.030	0.031	0.030	0.031	0.079	0.081
Sulfur, %	0.093	0.142	0.177	0.166	0.125	0.247	0.178
Sulfated ash, % (ASTM D 874)	1.05	1.00	1.05	1.05	1.04	1.11	1.12
HFRR wear scar, μm	183	**155**	**158**	**181**	**164**	206	209

Referring back to my November 2010 declaration, I showed there that the wear scar in Example 12 was 136 μm, which was a considerable improvement compared to the reference formulation using oleylamide, 210 μm (Example 11). In Table I, above, Example B is a duplicate of earlier Example 12, and the presently measured value of 155 is consistent with the earlier value of 136 μm.

I observe that Examples B through E all show similarly good results in terms of HFRR wear scar. That is, the performance is maintained with three different types of commercially available sulfurized olefins and at concentrations extending at least over the concentration range of greater than 0.15 to at least 0.75%. Example A, at only

0.15% sulfurized olefin, appears to be a borderline case, having a somewhat higher wear scar, although still better than that of Example 11 in my earlier declaration.

Examples F and G were run to investigate the performance of the present invention in a higher phosphorus formulation. It appears that at a phosphorus concentration of 0.08%, the effect of the present invention is not so apparent.

For completeness, I report a second set of experiments in which I ran the same series of sulfurized olefins as in examples A through G above, but in a different baseline formulation, namely, the formulation used in my declaration signed on June 25, 2010.

Table II

Component (wt%) Ex: and results	H*	I	J	K	L	M*	N*
Base oils	balance to = 100%						
Conventional additive components							
Viscosity modifier (90% oil)	8.2	8.2	8.2	8.2	8.2	8.2	8.2
Pour point depressant (54% oil)	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Succinimide disp't (50% oil)	7.2	7.2	7.2	7.2	7.2	7.2	7.2
ZDDP (9% oil)	0.5	0.5	0.5	0.5	0.5	0.8	0.8
Antioxidants	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Thiadiazole inhibitor	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Commercial foam inhibitor	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Overbased Ca detergents (~43% oil)	2.43	2.43	2.43	2.43	2.43	2.43	2.43
Overbased Mg detergent(50%oil)	1.31	1.31	1.31	1.31	1.31	1.31	1.31
Sulfurized olefin type							
Sulfurized carbobutoxy cyclohexene, %	0.15	0.5	0.75			0.5	—
Sulfurized C_{12}-C_{18} olefins, %				0.5			
Sulfurized lard and vegetable oils, %					0.5		
Phosphorus, %	0.050	0.049	0.048	0.048	0.049	0.077	0.077
Sulfur, %	0.177	0.223	0.255	0.246	0.207	0.281	0.215
Sulfated ash, % (ASTM D 874)	1.07	1.05	1.05	1.07	1.06	1.10	1.10
HFRR wear scar, μm	203	**188**	**180**	**192**	**184**	184	180

The results show consistent HFRR performance in this different base formulation, among a variety of sulfurized olefins in the concentrations of greater than 0.15 to at least 0.75 percent and at phosphorus levels below about 0.08%.

I further declare that all statements herein made of my own knowledge are true and all statements herein made on information and belief are believed to be true. I understand that willful false statements and the like are punishable by fine or imprisonment or both (18 U.S.C. 1001) and may jeopardize the validity of the application or any patent issuing thereon.

Virginia A. Carrick

3/1/11 (date)